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REMARKS

In response to the objection to the drawings, the "base surface of the second region (32)" and "the base surface of the third region (33) of the refractory unit (30) are aligned with an internal wall (70) of the oven" have been deleted from the claims by the cancellation of claims 28 and 29.

Claim 1 has been amended to insert --a-- before the word distribution to delete "the".

Claims 1-29 were rejected under 35 U.S.C. §112, second paragraph for failing to particularly point out and distinctly claim the subject matter that the applicant regards as the invention.

Reconsideration is requested.

The claims have been reviewed with regard to the Examiner's objections that the claims are narrative and replete with indefinite and functional or operation language. A number of amendments have been made to point out the relation of the elements of the claims. The claim elements are not listed as a catalog of parts but are recited in broad terms that indicate that the parts are associated with other structural elements and/or functions. The absence of a recitation of the means by which a particular element is connected to another element does not make a claim indefinite as the recitation that the elements are associated with other elements does point out the invention.

The inner central lance is defined in claim 1 as being arranged radially outwardly with respect to said inner central lance. This language locates the position of the outer lances. The means of attachment need not be recited in the claim in order to point out the invention. This is also the case for the at least two outer side lances.

In amended claim 1, it is stated that "said series of nozzles being in communication with a plenum defined by the volume inside said housing that

is internally lined with a coating of refractory material and is located between the inner central lance and the outer side lances". This language locates the series of nozzles that is located between the inner central lance and the outer side lances. Also, in amended claim 1 it is stated that in the flameless functioning mode "the combustible gas is injected to said inner central lance alone", whereas in the flameless mode the combustible gas is injected to said outer side lances alone.

Claim 1, as amended, points out that the burner comprises "a main metal body open at a first base end ... and internally lined with a coating of refractory material" and specifies that "the volume inside said coating defines a plenum". Support for this amendment is given on page 6, lines 23-25, of the specification of the present application as originally filed.

As noted above, it has been specified that the two outer side lances "are arranged radially outwardly with respect to said inner central lance". Support for this, is found in Figures 1, 2 and 6 and from line 2 on page 8 to line 6 on page 9, of the specification of the present application as originally filed.

Claim 1 has also been amended to specify that "a single duct for the introduction of pre-heated air into said plenum and which is connected to the side surface of said main metal body" and support for this is found in figures 6, 9, 12 and 12 and on page 6, lines 15-17 and 23-25, and on page 7, lines 1-3, of the description of the present specification as originally filed.

The feature according to which the gas burner comprises "a gas distributor associated to said housing for distributing the gas to said inner central lance and to said outer side lances" has been introduced and this is supported by the specification at page 6, lines 20-22, and in figures 4, 12 and 13 of the present application as originally filed.

Claim 1 has also been amended to point out that the gas burner comprises "a control system of said gas distributor" as described at page 10, lines 14-15, and at page 11, lines 13-16, of the present application as originally filed.

Minor amendments have been carried out for the sake of consistency.

New claim 30 is based on amended claim 1 and recites the following additional features:

- "said refractory unit comprises, in sequence from the innermost to the outermost, a first region, a second annular region and a third annular region which are concentric to said inner central lance," support is found on page 7, lines 23-25, and on page 8, line 1, of the description of the present application as originally filed and in Figures 1, 2 and 8 as originally filed.
- wherein "said first region comprises a central hole from which the gas flow out and which houses a tip portion of said inner central lance and a series of calibrated holes communicating with said plenum and with a cavity that is defined in said first region and communicates with the combustion chamber of an oven, the pre-heated air from said series of calibrated holes flowing into said cavity together with the gas injected through said inner central lance", support is found on page 8, lines 2-10, on page 9, lines 18-21, on page 11, lines 17-21, of the description of the present application as originally filed, in claims 2 and 5 as currently on file and in figures 1, 2, 8 and 9 as originally filed. It is noted that the annular crown 119 between the tip portion of the inner central lance and the hole 19 is always disclosed as optional.
- wherein "said second annular region comprises a series of nozzles communicating with said plenum for the injection of the pre-heated air into said combustion chamber of an oven"; support is found on page 8, lines 15-18, of the description of the present application as originally filed, in claim 3 as currently on file and in figures 1, 2, 5, 6, 9 and 10 as originally filed.
- wherein "said third annular region comprises at least two pass-through holes for housing said at least two outer side lances", support is found on page 9, lines 2-6, of the description of the present application as originally filed, in claim 9 as currently on file and in figures 1, 2 and 8 as originally filed.
- wherein "both said series of calibrated holes and said series of nozzles being in communication with said plenum and being located between the

inner central lance and the outer side lances”; support is found on page 10, lines 18-25, and on page 11, lines 19-25, of the description of the present application as originally filed and in figures 9 and 10 as originally filed.

New claim 31 is based on newly introduced claim 30 and also specifies that the gas burner comprises “activation means of said control system”. Support for this language is found on page 10, lines 13-15, and on page 11, lines 13-16, of the description of the present patent application as originally filed.

New claim 32 is based on newly introduced claim 31 and also specifies that:

- the first region of the refractory unit comprises “a housing that houses an ignition device and a housing that houses a flame detector device”; support is found on page 7, lines 8-18, and on page 8, lines 5-6, of the description of the present application as originally filed and in original claim 6.

- “activation means of said control system being provided to thereby continuously switching from a flame functioning mode of the burner, wherein the combustible gas is injected to said combustion chamber through said inner central lance alone and the combustion of said gas with the pre-heated air drawn through said series of calibrated holes takes place in a flame mode, upon ignition of said ignition device, to a flameless functioning mode, wherein, at a temperature above the self-ignition device of the gas in air, the combustible gas is injected to said combustion chamber through said outer side lances alone and the combustion of said gas with the pre-heated air drawn through said series of calibrated holes and said series of nozzles takes place in a flameless mode inside said combustion chamber”. Support is found on page 9, lines 14-16, on page 10, lines 5-17, and on page 11, lines 6-25, of the description of the present application as originally filed.

Claim 1, 5, 7, 8 and 10 were rejected under 35 U.S.C. §102(b) as being anticipated by Hovis in view of Cornelius or Wunning. Claims 2, 3, 5, 7, 8 and 10 were rejected under 35 U.S.C. §102(b) as being anticipated by Hovis in view of Cornelius or Wunning further in view of JP 07-190319. Claims 4,

10,-21 and 26-29 were rejected under 35 U.S.C. §103(a) as being anticipated by Hovis in view of Cornelius or Wunning, JP 07-1190319 and further in view of AT358702.

Reconsideration is requested.

It is believed that the amendments to claim 1 avoid the rejections for anticipation. Claim 1, as amended, and the claims that depend from claim 1 point out that the burner comprises "a main metal body open at a first base end ... and internally lined with a coating of refractory material" and specifies that "the volume inside said coating defines a plenum". In addition amended claim 1 specifies that the two outer side lances "are arranged radially outwardly with respect to said inner central lance.

Hovis discloses a gas burner which is described as always operating in a flame condition. Hovis is concerned with the problem of providing a burner capable of being efficiently operated during both the starting heating period and the final end period of a soaking cycle in a soaking-pit furnace. Hovis is not concerned with the problem of reducing NOx emissions. Contrary to the Examiner's opinion, the nozzles 80' (figures 8 and 10 of Hovis are not arranged between the inner central lance 92' and the outer side lances 116'. In Hovis the nozzles 80' are always arranged radially outwardly and externally with respect to the outer side lances 116'.

Hovis does not disclose a gas burner comprising a refractory unit as clearly specified in the new claims 30-32. The Hovis burner has outer air passages 80', which communicate with a respective "plenum" as shown in figure 8, there is a volume defined around the conduit 92 and, in figure 10, the volume is defined by the chamber 140 and inner air passages 88'. These communicate with another "plenum", (namely, in figure 8, the volume defined inside the conduit 92 and, in figure 10, the volume defined by the chamber 138 are different and separate from the "plenum" communicating with the outer air passages 80'.

In the Hovis patent, the outer air passages 80' are always arranged radially outwardly with respect to the outer side lances 116'.

On the contrary, in new claims 30-32, both the calibrated holes 16, which are defined in the first region of the refractory unit, and the nozzles 20, which are defined in the second annular region of the refractory unit, are both in communication with the same plenum. Moreover, in claims 30-32, both the calibrated holes 16 and the nozzles 20 are arranged between the inner central lance and the outer side lances. In other words, the outer side lances are arranged radially outwardly with respect to the inner central lance and with respect to the calibrated holes 16 and nozzles 20

The Corneilius patent discloses a combustion apparatus for a gas turbine wherein there is one single spray nozzle 16 that is fed by a fuel pipe 18 and two arrangements of adjusting ports for the introduction of primary and secondary air. The Corneilius combustion apparatus operates in a swirl-mode and in normal-mode, the switching from one mode to the other, as well as the rate of dilution of the combustion products, is achieved by means of primary and secondary air flows adjusting means.

Wunning discloses an impulse burner which can be utilized for indirectly heating a furnace chamber by means of radiator heating tube (figure 5 of Wunning). In said impulse burner the fuel inner central lance 18 and the fuel outer side lance 17 are coaxial one another, the fuel inner central lance 18 protrudes axially from the fuel outer central lance 17, the latter ending inside a combustion chamber 9 that is part of the impulse burner itself. In the impulse burner the air is introduced into the combustion chamber 9 and, from there it passes into the furnace chamber or radiator heating tube through openings which are arranged outwardly with respect to the fuel coaxial inner and side lances 18 and 17. No refractory unit is present in the Wunning impulse burner.

The Wunning impulse burner operates in a flame-mode, wherein the fuel is injected into said combustion chamber through the fuel outer side lance 17, and a flameless mode, where the fuel is injected into the furnace chamber or radiator heating tube through the fuel inner lance 18. In the gas burner of the present application the fuel outer side lances are arranged

radially outwardly with respect to the inner central lance in that the fuel outer side lances are radially distanced from the fuel inner central lance. Moreover, the gas burner claimed in the present application comprises a refractory unit which is completely absent in the Wunning impulse burner. Finally, in the gas burner pointed out in new claims 30-32, the calibrated holes 16 and the nozzles 20 through which the air is drawn are both arranged between the fuel inner central lance 11 and the fuel outer side lances 10.

The structural differences of the claimed gas burner are not made obvious by the cited references. The Wunning impulse gas burner because of its compactness and the symmetry of its structure, is capable of operating in a relatively small furnace chamber, developing in a substantially axial direction and free from obstacles, such as the one of a radiator heating tube. However, the Wunning impulse gas burner is not capable of operating in a oven, such as an industrial oven for the treatment of metallic pieces, wherein the combustion chamber can be very large in dimensions and the metallic pieces treated therein can be very bulky so as to impact the fuel and the air axially exiting from the impulse gas burner which can impede the mixing thereof with the combusted gas that is present in the combustion chamber.

On the contrary, the gas burner claimed in the present application, because of the radially disposed outward arrangement of the at least two fuel outer side lances with respect to the fuel inner central lance and with respect to the calibrated holes and nozzles through which the air is drawn, results in a good mixing of the combustible gas, the comburent air and the combusted gas inside a furnace chamber without the formation of a flame front even in combustion chamber having large dimensions when the furnace chamber is occupied by obstacles.

It is further noted that the coaxial arrangement of the inner and outer lances of the impulse burner of Wunning cools the lances because of the cold gas injected through them, whereas, in the burner according to the present invention, due to the arrangement of the outer side lances radially outwardly with respect to the inner central lance, it is necessary to provide an

additional cooling system (the annular crown around the pit portion of the inner central lance, which is the one more subjected to heat).

It is further noted, that in the flame operating mode of the burner of Wunning the fuel is fed through the outer lance 17, whereas in the "flame free" operating mode the fuel is fed through the inner lance 18, the inner lance 18 being axially arranged inside the outer lance 17.

In AT358702, the elements labeled with the reference numeral "13" are not fuel lances, as they are "swirling" elements inserted inside through holes 12 for the passage of air (Cf. claim 6 of AT358702). It is further noted that the said through holes 12 for the passage of air are located outside the conduits 15 and 16 that feed gas and oil fuel.

JP 07-190319 discloses multistage burner where a stable flame is formed by the use of baffles which comprise a plurality of passages. There is no mention of a central lance with outer side lances for feeding fuel to a burner. Nothing in JP 07-190319 suggests the structure recited in claim 1 and the claims that depend from claim 1.

For these reasons, it is respectfully submitted that the application of the teachings of Wunning, Corneilius, Hovis, AT 358702 or JP 07-190319 results from a hindsight analysis of the claimed invention as these references individually or collectively do not anticipate or make obvious the claimed invention. For these reasons, it is requested that the rejections for anticipation and obviousness be withdrawn.

An early and favorable action is earnestly solicited.

Respectfully Submitted


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